

NARRATIVE - SUMNER CO BOARD OF EDUCATION

The Gallatin Middle School in Gallatin, Tennessee is approximately 67,049 square feet in area. Ventilation requirements of the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) were utilized in this study.

The base concept for the heating, ventilating, and air conditioning (HVAC) system were a standard 2-Pipe system utilizing a circulating water loop, natural gas-fired boiler and closed circuit cooler for heat addition and rejection. The system would be controlled by thermostats located in respective zones.

The geothermal system utilizes very similar heat pump equipment as a water source heat pump system except heat is rejected and added via heat exchangers configured vertically in the ground. Each heat exchanger is located in a vertical bore about 300 feet deep. The building interior water loop is circulated via pumps to the "borefield" located outside, underground. Each bore contains a 1-inch supply and return pipe. The extent or number of bores determines the overall capability to reject heat or absorb heat from the constant temperature ground soil. Thus, no boiler or cooler is needed for the water loop. All heat exchanger is confined to the borefield.

The geothermal units are capable of handling water loop temperature ranges lower than the usual water source heat pumps. This feature usually allows the heat pumps to operate at cooler refrigerant temperature which allow greater mechanical efficiencies and extended equipment life. Therefore, energy and maintenance costs are significantly less than other concepts. Also, the statistical service life of this equipment is twenty years.

A test bore was prepared and tested at a location near this project site which indicated a ground temperature and thermal conductivity. The following results were found:

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|----------------------|-----------------|
| Thermal Conductivity | 2.1 btu/hr-ft-f |
| Ground Temperature | 59.8 Degrees F |

The above values are favorable. The computed length of bores is about 29,100 feet, requiring about 97 bores, three hundred feet deep and 20 feet on centers.

The computed data for the geothermal concept indicates an annual cost savings of 30,569 in utilities, as compared to the 2-Pipe system. The comparison on a building basis is as follows:

| | |
|-------------------------|--------------------|
| Standard 2-Pipe System: | \$1.02 per sq. ft. |
| Geothermal System: | \$0.57 per sq. ft. |